

The Health Transition: Implications for Health Policy in Developing Countries

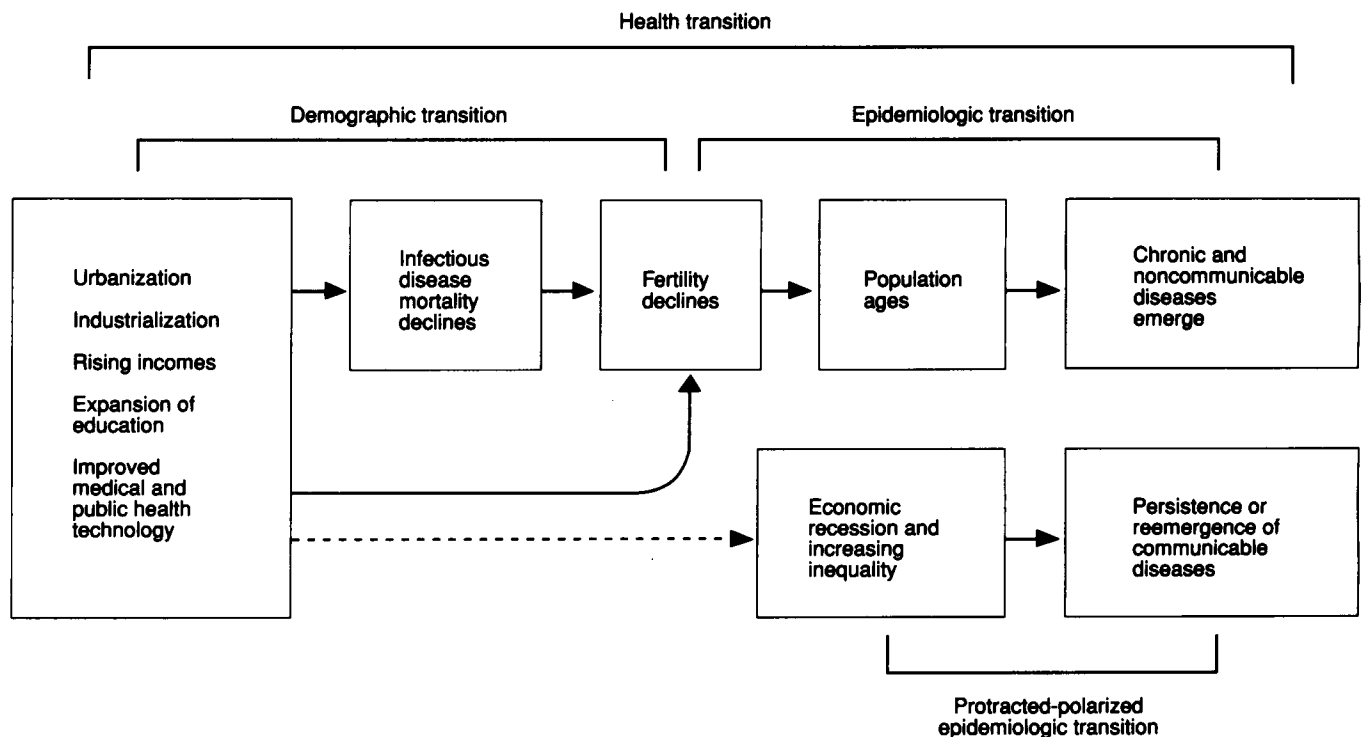
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Changing epidemiologic profiles of developing countries are leading—in many countries quite rapidly—to fundamental changes in the volume and composition of demand for health services and needs for health promotion. The purpose of this collection has been to attempt to take stock, in a systematic disease-by-disease manner, of the potential for cost-effective responses to this changing pattern of needs. Although considerations of intervention cost-effectiveness (or value-for-money) were important even before rapid change in epidemiologic profiles, the relatively limited range of key

interventions for communicable childhood disease led, through experience, to a reasonable sense of a cost-effective mix of interventions. The situation becomes vastly more complex with the emergence, as quantitatively important, of a broad range of additional conditions; hence the motivation for the systematic analyses reported in this collection.

Chapter 1 described the approach taken in the chapter-specific analyses and summarized the resulting conclusions concerning cost-effectiveness. Our purpose in this chapter is to explore, in a more general way, the implications of the

Figure 29-1. Relationships among Demographic, Epidemiologic, and Health Transitions



Source: Authors.

epidemiologic and health transition for health policy. We begin by reviewing the global health transition and its constituent demographic and epidemiologic transitions. We then turn to discussion of the implications of these transitions for national governments and, in closing, we explore implications for international aid.

The Health Transition

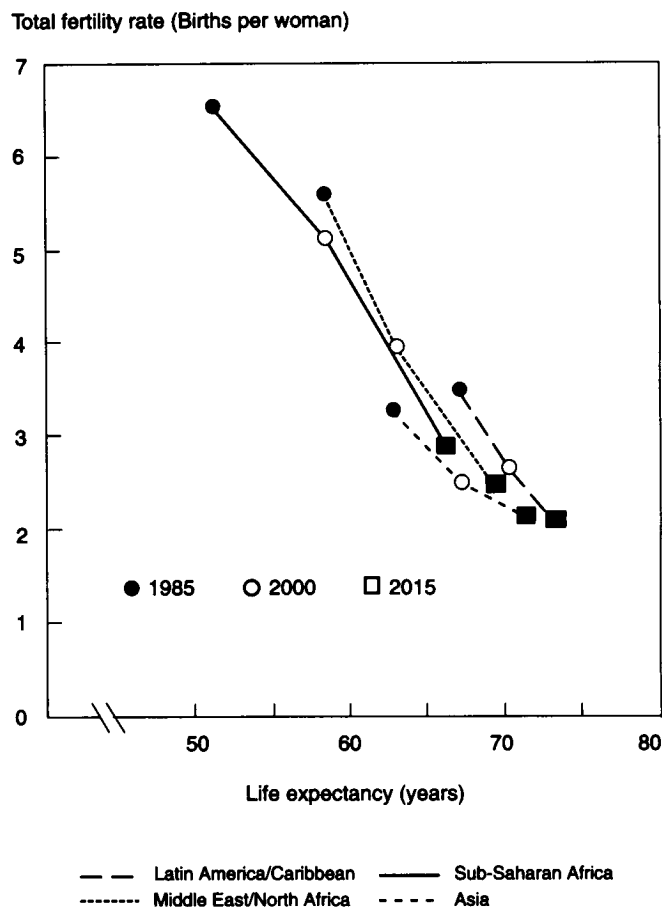
Essential to an understanding of the evolution of disease control priorities in developing countries is a reasonable projection of probable changes in the pattern of disease. These changes are likely to be profound. Our discussion of these changes divides naturally into four parts—the first deals with the demographic transition, the second deals with the epidemiologic transition, the third deals with the changing risk environment that has been occurring, and the fourth deals with the widening gap in health problems and health needs across social and economic classes. Collectively these changes are coming to be referred to as the “health transition,” and figure 29-1 illustrates relations among the demographic, epidemiologic, and health transitions.

The Demographic Transition and Population Aging

Health patterns in the developing world during the next three decades will be profoundly influenced by recent and projected future declines in fertility and mortality as these nations pass through the demographic transition. Figure 29-2, which is drawn from the demographic analyses prepared for this collection, projects declines in the total fertility rates and the gains in life expectancy that might be expected in each of four regions of the developing world during the thirty years 1985 to 2015, assuming reasonable and achievable continuation of established trends. (Table 29-1 provides detail by region on the demographic parameters estimated for 1985–90 and projected for 2000–2005; definitions of the regional groupings that are used may be found in chapter 1, table A-1.) The projected declines in fertility for Sub-Saharan Africa and the Middle East are substantial, averaging 50 percent, whereas the gains projected for life expectancy are more modest, ranging from 10 percent in Latin America to 25 percent in Sub-Saharan Africa.

Long-term projections are inevitably tentative; nonetheless, it should be noted that fertility changes of this magnitude in a thirty-year period are not unprecedented. The total fertility rates in the Latin American and Asian regions ranged from 5.5 to 6.0 births per woman in the late 1950s and declined to their present levels of 3.3 to 3.5 in less than thirty years. Perhaps more problematical are the projected mortality declines. These do not yet take into account the acquired immunodeficiency syndrome (AIDS) epidemic, which has assumed significant proportions in many countries in Sub-Saharan Africa and Latin America. Nonetheless, much of the developing world is now well through a transition from high mortality and fertility rates to low ones; this demographic transition sets the stage for epidemiologic change.

Figure 29-2. Regional Projections of Life Expectancy and Fertility



Source: Bulatao and Stephens 1990.

It is commonly assumed that the changing health picture seen in populations undergoing the demographic transition is primarily a function of the declines in mortality. In fact, however, the age structure and, correspondingly, the cause structure of death during the course of the demographic transition is strongly influenced by the rapid decline in fertility. (The role of mortality decline in creating preconditions for fertility decline nonetheless leaves mortality decline as a central *indirect* cause of epidemiologic change. Figure 29-1 illustrates this point.) This occurs because of a phenomenon that is described by demographers as the “momentum” of population growth. To explain simply, with high fertility the age structure of a population is highly skewed toward the young, irrespective of the level of mortality (figure 29-3). With sustained high birth rates and larger numbers of women entering the reproductive ages every year, the base of the population is continually expanding as more births are added every year. With the onset of the fertility transition and rapidly declining birth rates, however, the number of births added each year may remain unchanged or even decline. Consequently the age structure of the population will be progressively transformed

Table 29-1. Demographic Parameters, Globally and by Region, 1985–1990 (Estimates) and 2000–2005 (Projections)

Region ^a	Population (millions)		Crude birth rate (per 1,000 population per year)		Crude death rate (per 1,000 population per year)		Total fertility rate ^b		Life expectancy at birth (years) ^c	
	1985	2000	1985–90	2000–5	1985–90	2000–5	1985–90	2000–5	1985–90	2000–5
Industrialized market economies	760	810	13	12	9	10	1.7	1.8	76	78
Industrialized transition economies	416	453	17	15	11	10	2.3	2.1	70	73
Subtotal, industrialized economies	1,176	1,263	15	13	10	10	1.9	1.9	74	76
Latin American and Caribbean	402	529	29	21	7	6	3.6	2.5	67	71
Sub-Saharan Africa	556	720	46	40	15	11	6.4	5.4	52	57
Middle East and North Africa	376	573	40	32	10	8	5.6	4.3	60	65
Asia and the Pacific	2434	3,118	27	21	9	8	3.3	2.6	64	68
Subtotal, developing countries	3,668	4,940	31	25	10	8	3.9	3.1	62	66
World total	4,844	6,203	27	23	10	8	3.4	2.9	65	68

a. Appendix 29A lists countries in each grouping.

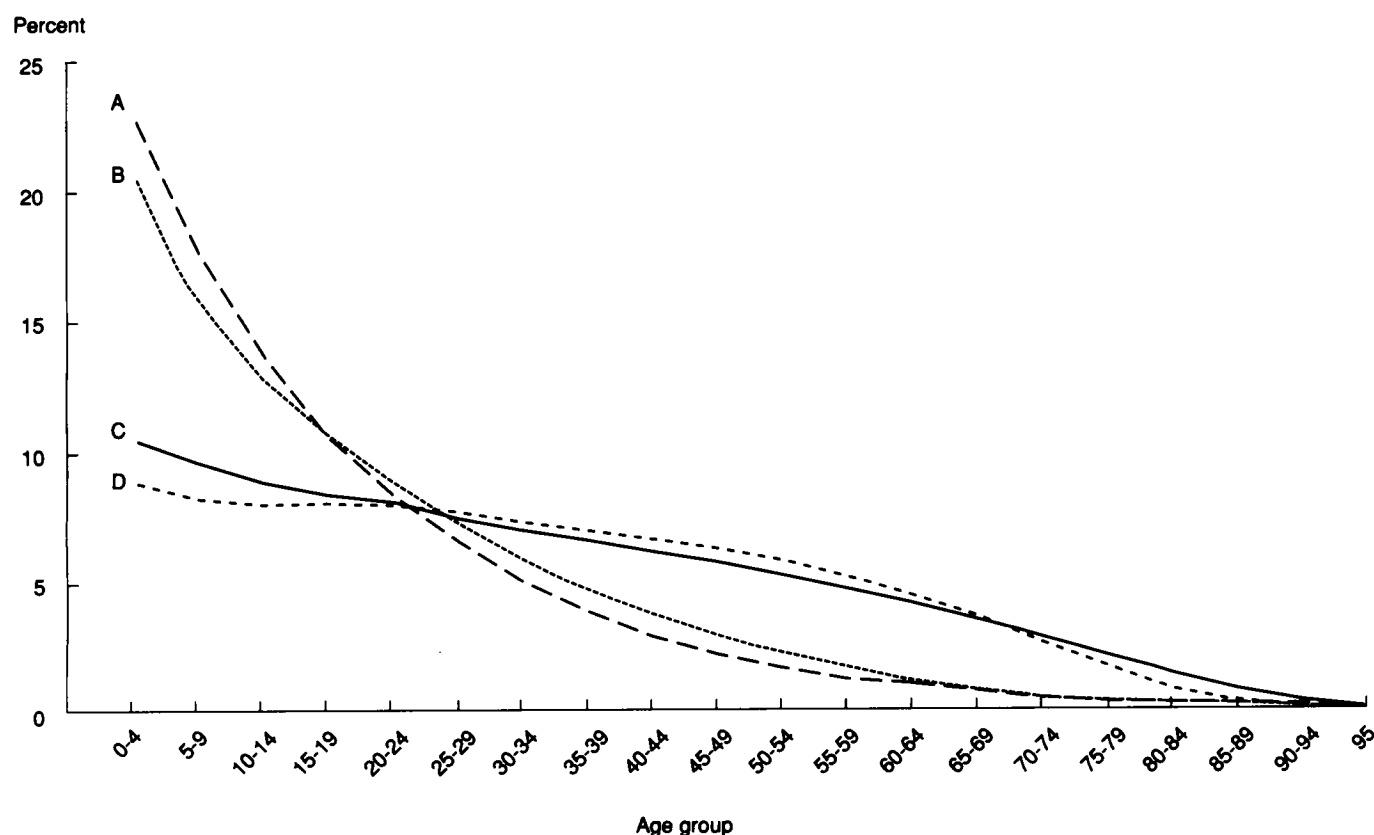
b. Number of children a woman would be expected to bear during her reproductive years, based on the age-specific fertility rates prevailing in that period.

c. Average of the male and female life expectancies reported in the source table.

Source: Bulatao and Stephens 1990.

Figure 29-3. Age Distribution of the Population

(figures based on alternative mortality and fertility assumptions)



Note: Percent distribution of the female population by age groups in West model life tables. Curves A and B represent a gross reproduction rate of 4.0 (eight births per woman) with life expectancies of seventy-five years (curve A) and forty years (curve B). Curves C and D represent a gross reproduction rate of 1.5 (three births per woman) with life expectancies of seventy-five years (curve C) and forty years (curve D).
Source: Coale and Demery 1983.

from the shape of a broad-based triangle to a rectangular or even trapezoidal shape with a narrowing of the base (figure 29-3). The pace of fertility decline will be directly reflected in an immediate slowing (and even reversal) in the growth of the youngest age groups. The adult population will, however, continue to grow for several decades because of the continuing aging of the larger cohorts of persons already born.

Figure 29-4 illustrates this phenomenon for Latin America. Although the size of the age cohort under five years old changes very little during the thirty-year period, there is a dramatic increase from ages forty-five through sixty-four. In the very long run (more than a century) the numbers of the elderly in the rapidly growing developing countries can increase in size by more than 100 times (Chesnais 1990). Kinsella (1988) examines a broad range of consequences, in addition to the health ones we address here, of population aging in developing countries during the next several decades.

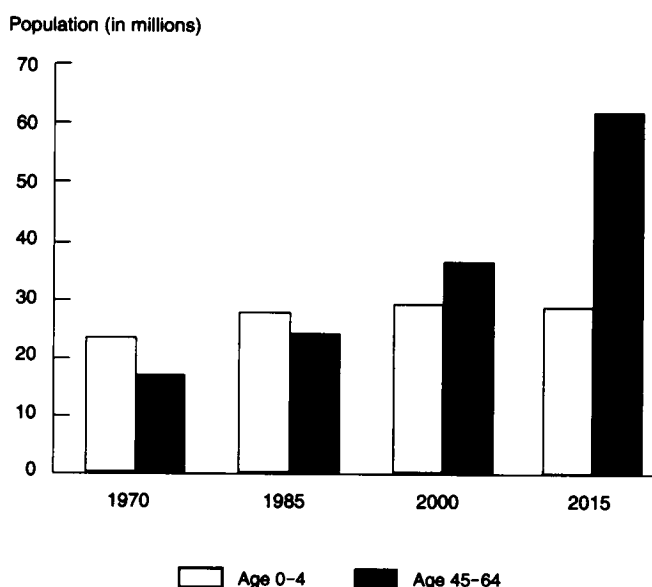
The Epidemiologic Transition

The transformation in the age structure of mortality associated with the demographic transition leads to a transition in its

cause structure that has been termed the “epidemiologic transition” by Omran (1971). Omran identifies three phases in this transition: the age of pestilence and famine, the age of receding epidemics, and the age of degenerative and man-made diseases. In table 1-1 (and table 29-7), the “unfinished agenda” and the “emerging problems” illustrate the health conditions that are typically prominent, for children and for adults, in the pre- and postepidemiologic transition environment, respectively. (We consider phase three to be the posttransition phase.)

Olshansky and Ault (1986) proposed a fourth phase in the epidemiologic transition—the age of “delayed degenerative diseases.” This phase was proposed because of the progressive decline in the death rates from some chronic diseases associated with steady gains in life expectancy among the aged in the United States and some other industrial countries. Crimmins, Saito, and Ingegneri (1989) have reported for the United States that these gains in survival among the aged have in large measure been in “disabled” years rather than “healthy” life. In this circumstance, improved survival among the aged implies that there will be an increasing, not lessening, demand for health services (Verbrugge 1984, 1989). Fries (1989), however, notes that in the United States in recent years there have

Figure 29-4. Estimates of Male Population of Latin America, Age Groups 0–4 and 45–64, 1970–2015



Source: Bulatao and Stephens 1990.

been substantial declines in the incidence of such conditions as heart disease, lung cancer, and automobile accidents. He observes that “successful aging” with lessened infirmity can be achieved if medical systems pursue vigorously the path of prevention rather than concentrating on developing sophisticated means of treating diseases after they are recognized.

Because of the central role of population dynamics in shaping the profile of illness and the pattern of cause of death, it is worth discussing these matters somewhat further. Preston (1986) has shown that from the time a population comes down to and maintains replacement reproduction levels (total fertility rates approximately 2.1) the entire growth of the population occurs only in the population segment beyond the mean age of childbearing (approximately twenty-eight years). He concludes: “Population momentum turns out to be momentous only for mature adult ages where productivity is typically highest and where concerns regarding the economic effects of rapid growth are probably least” (p. 349). The implications of population momentum in older age groups for the health system are, however, dramatic. Table 29-2, which is derived from World Bank projections, shows the percentage changes in the population size by age group projected to occur in each of the four developing country regions over the thirty-year period 1985 to 2015.¹ This illustrates the marked changes in the age structure of these populations that will result, primarily as a consequence of dramatic declines in fertility. In the cases of Asia and Latin America, where fertility declines have been well under way for the last twenty years, there would be very little change in the size of the populations under age fifteen in the next thirty years; by contrast, the populations over age forty-five would increase by over 130 percent. These increases would represent growth rates of 2.8 to 3.2 percent per year

during the thirty-year period, reflecting the momentum of population growth that follows the historical patterns of high fertility.

At the other extreme, Sub-Saharan Africa, which experienced no significant fertility declines prior to 1985, will continue to show large increases in the population down to age fifteen and then smaller increases in the younger ages, reflecting the much later (probable) onset of a fertility decline. In the Middle East and North Africa, a somewhat earlier onset of fertility decline is projected. Again, the large increases in the older age groups in these regions reflect the momentum of population growth.

It should be clear from table 29-2 that, even if there were no change in age-specific morbidity and mortality rates, projected declines in fertility would have a significant effect on the age structure and, therefore, on the relative frequency of different causes of death simply because the population is aging. For example, in Latin America, all things being equal, we could expect that this change in age structure would be accompanied by more than a doubling of chronic disease among adults in relation to acute diseases among infants and children. In fact, however, mortality rates from these conditions probably will decline. As shown in table 29-2 these projected mortality declines are greatest (decreases of 60 to 70 percent) in the youngest age groups and least (decreases of 7 to 18 percent) in the oldest age groups.

Interactions of changes in mortality with the changes in age structure will result in an even more drastic transformation of the health picture. This is also shown in table 29-2, which gives the percentage changes in numbers of deaths that are projected to occur within each age group by the year 2015. Again taking Latin America as an example, among children under five projections show only a 2 percent increase in the population size but a 62 percent decline in the age-specific mortality rate, resulting in a 61 percent decline in number of deaths. By contrast, in the oldest age group the projections show a 141 percent increase in the population size but only a 12 percent decline in mortality, resulting in more than a doubling of the number of deaths and an even greater increase in chronic disability. This epidemiologic transition will have important consequences for the organization and delivery of health services in the future.

Changing Patterns of Risk

In addition to changes in population age structure, which is the primary determinant of epidemiologic transition, there are global social and economic trends which are transforming the risk factors for different diseases (Kjellstrom and Rosenstock 1990). The most obvious global shift is from rural to urban living. In 1985, only 31 percent of the population of the developing regions of the world resided in urban areas, in comparison with 72 percent in the industrial regions (United Nations 1989). But the urban growth rate in the developing regions is projected at 3.6 percent per year through the end of the century, so its urban population will reach 40 percent by

Table 29-2. Projected Change in Population, Mortality Rates, and Deaths between 1985 and 2015, by Age Group
(percent)

Region	Age group					All ages
	0-4	5-14	15-44	45-64	65+	
<i>Asia</i>						
Population	5	7	53	131	134	51
Mortality rates	-70	-58	-43	-30	-7	-18
Deaths	-68	-55	-13	62	118	23
<i>Latin American and Caribbean</i>						
Population	2	18	57	159	141	63
Mortality rates	-62	-60	-47	-29	-12	-17
Deaths	-61	-53	-21	84	112	35
<i>Middle East and North Africa</i>						
Population	38	70	127	175	150	102
Mortality rates	-64	-65	-57	-36	-18	-43
Deaths	-50	-44	-2	76	105	15
<i>Sub-Saharan Africa</i>						
Population	70	116	163	151	161	132
Mortality rates	-64	-64	-53	-29	-11	-45
Deaths	-40	-22	24	79	132	28

Source: Calculated from Bulatao and Stephens 1990.

the year 2000 and 50 percent by 2015. This rapid shift from a rural subsistence economy to an urban, market-oriented, industrial economy brings with it a range of new health problems (Susser 1981). At the same time, economic growth brings with it the wherewithal and knowledge for populations to acquire the nourishment and sanitation that can reduce the incidence of and fatality rates from communicable disease. Reductions in risk for communicable disease combined with increases in other risks, further discussed below, have the potential to amplify the effects of demographic trends. An important general conclusion from a recent study of adult health in developing countries by Feachem and others (1992), however, is that the *overall* effect of development on age-, sex-, and cause-specific mortality rates for noncommunicable disease is to lower them, despite the often-increasing prevalence of well-established risk factors of modern society.

High rates of injuries related to motor vehicles, industrial accidents, and toxic chemicals (for example, pesticides) are one consequence of rapid urbanization, industrialization, and mechanization of agriculture. Stansfield, Smith, and McGreevey (chapter 25) provide extensive documentation of the dramatic increase of these categories of injuries in developing countries. For example, in Thailand in the age group of one to forty-four years, motor vehicle mortality has been increasing at 30 percent annually, moving from sixth place to first place among all causes of death between 1947 and 1980. In 1978, mortality rates per vehicle were fifty times higher in Ethiopia and Nigeria than in the United States or the United Kingdom. Pesticides in Sri Lanka in 1978 caused almost twice as many deaths as occurred as a consequence of polio, diphtheria, tetanus, and pertussis combined. In India, mechanization of grain mills without appropriate protective shields over

drivebelts resulted in an increased number of serious injuries. Injuries are particularly a problem in many poor countries, which lack the resources and institutions to establish and enforce safety measures. Noteworthy, throughout the world in developing and industrial countries alike, injuries are now the leading cause of death during half the human life span (Stansfield, Smith, and McGreevey, chapter 25).

Chronic conditions such as cardiovascular disease, cancer, and chronic obstructive pulmonary disease are also recognized to be substantially influenced by economic and environmental factors, some of which are amenable to modification by the health system in ways that are reviewed in the chapters in part 4 of this collection. For example, the U.S. Department of Health, Education, and Welfare identified lifestyle and the environment as the primary determinants of mortality for all but one of the ten leading causes of death over age one in the United States in 1975 (USDHEW 1978). A more recent analysis indicated that just three preventable precursors to premature death in the United States—alcohol, tobacco, and injury risks—accounted for 59 percent of all preventable years of life lost before age sixty-five and 54 percent of all preventable days of hospital care (Amler and Eddins 1987).

Smoking provides an excellent illustration of an emerging health problem (Zaridze and Peto 1986; Stanley, appendix A). In the United States it is now well established that tobacco use is currently responsible for more than 30 percent of all cancer deaths, including cancers of the lung, larynx, oral cavity, pharynx, pancreas, kidney, and bladder (Ernst 1988). The most dramatic evidence of this is the tenfold increase in lung cancer mortality in the United States since the turn of this century, with differential trends in males and females reflecting differences in smoking habits (Lopez, chapter 2). Similar dra-

matic increases in lung cancer mortality associated with cigarette consumption have been observed in Japan since World War II, and rising rates have also been reported from Singapore and Shanghai in recent years (Lee and others 1988; Barnum and Greenberg, chapter 21). In some Latin American and Caribbean cities more than half of the young people smoke; by the mid-1980s it is estimated that at least 100,000 deaths in this region were caused by smoking (USDHHS 1992). The rapid increase in smoking in China has the potential of leading to actual increases in age-specific mortality rates, which would run counter to standard demographic assumptions as reflected, for example, in table 29-1 (Yu and others 1990). Bumgarner and Speizer, chapter 24) have illustrated the plausibility of this outcome with quantitative projection models, and Lopez (chapter 2) summarizes analogous predictions for other parts of the world.

The relation between cigarette smoking and lung cancer illustrates a vitally important feature of chronic noncommunicable diseases—the long latent period between exposure and onset of the disease. Smoking is also one of the strongest risk factors for chronic obstructive pulmonary disease (COPD) and ischemic heart disease (Bumgarner and Speizer, chapter 24, and Pearson, Jamison, and Trejo-Gutierrez, chapter 23); as with cancer, the latency of effect is long for COPD and irreversible; but with ischemic heart disease, cessation confers substantial reduction in risk within a year. These data highlight the importance of taking action to prevent chronic diseases decades before the epidemic appears. Regrettably, a recent review (Masironi and Rothwell 1988) found that the rate of tobacco consumption in developing countries is increasing; consistent with this, Barnum and Greenberg (chapter 21) have found a strong relationship between tobacco consumption and higher levels of national income among developing countries.

Ischemic heart disease and stroke, other major causes of death among adults, are potentially amenable to early preventive interventions. Although all the determinants of ischemic heart disease remain to be defined, and patterns of attributable risk will certainly differ in developing countries from those of the industrial countries, where epidemiologic data are available, several behavioral risk factors are well established. These include smoking, sedentary lifestyle, and high saturated fat diets (Pearson, Jamison, and Trejo-Gutierrez, chapter 23). In general these behaviors are strongly associated with urbanization in low-income countries. For example, Popkin and Bisgrove (1988, p. 9) reported that “urban residents consume increased amounts of processed foods, meats, fats, sugar and dairy products while rural residents consume more coarse grains, roots and tubers and pulses.”

China provides a remarkable example of the transition to unhealthy diets. The rapid increase in income and related social and agricultural advances has led to a rapid increase in the proportion of obese Chinese and the proportion of Chinese consuming a very high-fat diet, although a large proportion still have a very low-fat diet and are exceptionally lean. For instance, a nationwide survey found that close to one-fifth (18.3 percent) of the highest tercile of Chinese consumed a

diet with over 30 percent energy from fat, whereas close to half (47.8 percent) of the lowest tercile consumed a diet with less than 10 percent of energy from fat (Popkin and others 1992).

An increase in the rate of ischemic heart disease is already being seen in some developing countries as they proceed through the epidemiologic transition. Singapore has experienced a doubling of the heart disease mortality rates during the past two decades in older age groups, although there appears to be a leveling off in the increase among younger males in recent years (Hughes 1986). As shown by the experience of Japan, however, which has a low rate of ischemic heart disease (although not stroke), economic development need not be associated with the disease patterns seen in most Western populations. Developing countries generally have fewer risk factors for some of the diseases associated with Western culture (Rose 1985). The course of these chronic diseases in the future will depend on the choices made by developing countries as they consider alternative health development strategies while proceeding through the epidemiologic transition.

The onset of the global AIDS epidemic has brought sexually transmitted diseases (STDs) to the forefront of the health agenda of many developing countries. The risk factors for STDs are directly related to patterns of sexual behavior. These, in turn, are often related to the development process. For example, in many developing countries, factors contributing to high rates of STDs include increasing urbanization with disruption of traditional social structures, increased mobility for political or economic reasons, poor medical facilities, and high unemployment rates (Piot and Holmes 1989). Over and Piot (chapter 20) present data which show that the high rate of human immunodeficiency virus (HIV) infection in eighteen African cities can be correlated with a low ratio of females to males in urban centers, creating a high demand for prostitutes. An associated factor of significance is the relatively low level of female education, which suggests that where there are fewer alternative economic opportunities for women, prostitution is more frequent. Reducing the risk of HIV in these circumstances will probably require significant social changes relating to the role and status of women (including increasing female education) as well as promoting the use of condoms and treating coexisting STDs.

Epidemiologic Polarization

During the next three decades the most dramatic declines in mortality in the developing regions of the world are projected for the infectious and parasitic diseases that primarily affect infants and young children; relatively modest changes are projected for the death rates for conditions such as cardiovascular disease, cancer, and other chronic diseases.² As a result, as tables 29-3 and 29-4 suggest, these chronic, noncommunicable diseases of adults will rapidly emerge as the leading causes of death in developing countries. Table 29-3 shows estimates and projections of mortality by broad category of cause based on model life tables; table 29-4 shows, for 1985 only, the best available empirical estimates, using vital statistics and epide-

Table 29-3. Major Causes of Death in Industrial and Developing Countries, 1985 and 2015
(percent)

Cause of death	Industrial countries		Developing countries	
	1985	2015	1985	2015
Infection	9	7	36	19
Neoplasms	18	18	7	14
Circulatory problems	50	53	19	35
Pregnancy-related deaths	0	0	1	1
Perinatal problems	1	1	8	5
Injuries	6	5	8	7
Other	15	16	21	19
Total number of deaths (millions)	12.0	14.5	37.9	47.8

Note: These estimates (1985) and projections (2015) are based on assumptions about changes in total mortality rates built into the World Bank's demographic projections model and on historically based assumptions about the relationship between mortality by cause and mortality level. Countries included in the "Industrialized" and "Developing" categories are found in appendix 29A.

Source: Bulatao and Stephens 1990.

miologic data. Both tables, and the preceding discussion, point toward the same conclusion: a health transition of massive proportions is well under way in the developing world, and it will continue for several more decades at least.

A critically important feature of the health transition is the emergence of epidemiologic polarization within and between countries of the developing world. In recent years economic growth in the developing world has not been steady. The worldwide recession, poor economic management, and the excessive accumulation of debt have led to serious setbacks in the economic circumstances of many developing countries. One potential consequence has been the stagnation or even

decay of the health advances that had been achieved in recent decades in some countries, which is often reflected in a rising occurrence of childhood malnutrition (Albanes and others 1989; Cornia, Jolly, and Stewart 1987; and Bell and Reich 1988). These setbacks, combined with a wide disparity in health conditions of different social classes, have been characterized by Bobadilla, Frenk, and their colleagues (Frenk and others 1989; Bobadilla and others, chapter 3) as "epidemiologic polarization."

Available evidence suggests that these setbacks in progress and continuation of polarization rarely result in a reversal in the pace of mortality decline (Hill and Pebley 1990),

Table 29-4. Deaths by Cause, Industrial and Developing Countries, 1985

Cause of death	Industrial countries		Developing countries	
	Number (000)	Percent	Number (000)	Percent
Infectious and parasitic diseases	506	4.6	17,000	45.0
Diarrheal diseases	—	—	5,000	13.0
Tuberculosis	40	0.4	3,000	7.9
Acute respiratory illness	368	3.3	6,300	16.6
Measles, pertusis, diphtheria	—	—	1,500	4.0
Other	—	—	4,800	12.7
Other measles and pertusis	..	..	700	1.8
Malaria	..	..	1,000	2.6
Schistosomiasis	..	..	200	0.5
Other	..	..	800	2.1
Maternal causes	5	0.05	500	1.3
Perinatal causes	100	0.9	3,200	8.4
Cancers	2,293	20.8	2,500	6.6
Chronic obstructive pulmonary disease	385	3.5	2,300	6.1
Circulatory and certain degenerative diseases	5,930	53.7	6,500	17.1
Ischemic heart disease	2,392	21.7	—	—
Cerebrovascular disease	1,504	13.6	—	—
Diabetes	153	1.4	—	—
External causes (injuries)	772	7.0	2,400	6.3
Other and unknown	1,054	9.5	3,500	9.2
Total	11,045	100.0	37,900	100.0

— Not available.

.. Negligible.

Source: Lopez (chapter 2, this collection).

even for Africa (Feachem, Jamison, and Bos 1991). This is best documented in the recent report of the demographic and health surveys (DHS) in twenty-seven countries in Africa, Asia, and Latin America, carried out between 1986 and 1990 (Sullivan 1991).³ They showed declines in mortality of children under age five in every country; by region the average percentage declines were: North Africa, 46 percent; Latin America, 32 percent; Asia, 28 percent; and Sub-Saharan Africa, 12 percent. Although effective health interventions may have blunted the potential mortality consequences of economic stagnation, evidence is emerging from several countries that low child mortality levels can now be maintained even in the presence of sustained high levels of malnutrition and morbidity (concerning Sri Lanka, see Gunatilleke 1989; concerning Zimbabwe, see Sanders and Davis 1988). It is important that the persistence of these undesirable states, as is emphasized in chapter 3, not be masked by undue focus on (relatively) favorable mortality statistics.

Table 29-5 illustrates the wide disparity in levels of child mortality (under five years) seen among developing countries in every region of the world in the 1980s. Mortality levels range from under 2.5 percent in Costa Rica and Cuba to over 20 percent in Bangladesh and Mali. Within countries as well, significant disparities in health conditions are found among subgroups of the population. Some of the most recent estimates of these conditions are from the recent DHS (Rutstein 1992). Tabulations of the levels and differentials in mortality of children under age five, when grouped according to urban as against rural residence and the mother's level of education, are presented in table 29-6. In general the data indicate child mortality rates 30 percent to 50 percent lower in urban than in rural areas, and a two- to threefold difference between women with no education and those with seven or more years of education.

The relation between maternal education and child survival in developing countries has been observed in multiple studies during the past decade (Caldwell and McDonald, 1981; Cochrane, Leslie, and O'Hara 1982; Hobcraft, McDonald, and Rutstein 1984) and has led some demographers to observe that what counts in child survival is not just the overall health and socioeconomic condition of the country where one resides but the individual's (or family's) social and economic resources. The urban-rural mortality differentials in table 29-6 provide one indicator of the disparity among families in different settings. In this context, because social and economic development usually does not occur uniformly throughout all areas of a country, one will frequently see important differentials in mortality rates in different geographic regions within countries. Examples include Mexico, Brazil, Kenya, Nigeria, India, and Indonesia. Thus, epidemiologic polarization occurs not only across social classes but in regional mortality differentials as well.

The analysis above is limited to infant and childhood mortality primarily because there are relatively few data on mortality differentials by social class among adults in developing

Table 29-5. Probability of Dying by Age Five, by Country, 1980-85

Probability of dying by age five (percent)	Latin America	Asia	Africa
25-30	none	none	Mali
20-25	none	Bangladesh	Liberia Senegal
15-20	Haiti	India	Ghana Uganda
10-15	Guatemala Peru	Turkey	Egypt
5-10	Brazil Dominican Republic Ecuador El Salvador Mexico	Philippines Thailand	Botswana
2.5-5	Argentina Chile Colombia Panama Trinidad Uruguay	Kuwait Malaysia Sri Lanka	none
<2.5	Costa Rica Cuba	Hong Kong Singapore	

Source: Hill and Pebley 1990; updated by Hill, personal communication.

countries. Where data are available, the patterns are similar to those well documented in the industrial countries; mortality rates for most chronic diseases among adults are higher among the lower social classes than among the upper classes (Kaplan and others 1987; Feachem and others 1992; World Bank 1989). For example, in a study of mortality in the rich and poor areas of Pôrto Alegre, Brazil, Barcellos and others (1986b, p. 206) found that death rates for men between forty-five and sixty-four were 50 percent higher among the poor, with death rates for cancers, cardiovascular diseases, respiratory diseases, and injuries all higher among men living in poor neighborhoods. The reasons, as in the industrial countries, relate to a high-risk lifestyle that includes alcohol consumption, smoking, lack of exercise, and obesity, as well as poor living and working conditions.

In many countries of the world, particularly across Asia, women experience excess mortality as compared with men because of their marginalized position in society (Das Gupta 1987). These excesses are most evident in the higher rates of infant and childhood mortality among females. Another reflection of the disadvantaged position of women is the extraordinarily high rate of preventable maternal mortality in many developing countries, which is 100 to 500 times higher than in the industrial countries (Walsh and others, chapter 17). Among the surviving women, studies in many parts of the world have documented a higher prevalence of stunting and

Table 29-6. Mortality Rates of Children Younger than Five Years, by Residence and Mother's Education, Selected Countries, 1986–90
(deaths under age 5 per 1,000 births)

Country	Type of residence		Mother's education			
	Rural	Urban	None	1–3 years	4–6 years	7 or more years
<i>Africa</i>						
Egypt	164	88	161	116	108	48
Morocco	137	81	125	76	66	50
Tunisia	88	62	84	71	58	39
Mali	303	203	290	244	214	112
Liberia	239	216	242	*	*	177
Senegal	250	135	226	179	123	75
Uganda	191	164	195	222	173	144
Togo	169	131	170	163	131	89
Ghana	163	131	175	119	169	125
Burundi	186	163	191	167	141	90
Kenya	91	89	109	101	92	70
Zimbabwe	98	55	120	94	83	60
Botswana	56	57	62	52	47	53
<i>Asia</i>						
Indonesia	124	78	144	139	99	48
Thailand	52	35	76	88	47	19
Sri Lanka	43	40	72	47	41	35
<i>Latin America</i>						
Bolivia	168	114	180	166	141	70
Peru	153	74	169	147	113	53
Guatemala	130	99	136	122	84	44
Brazil	121	88	136	137	70	40
Mexico	104	59 ^b	112	91	54	29
Ecuador	99 ^a	63 ^a	159	121	74	49
Dominican Republic	66 ^a	69 ^a	136	100	96	66
Paraguay	47	43	65 ^c	51 ^c	41 ^c	27 ^c
Colombia	32	35	74	—	—	26 ^d

— Not available.

* Less than 500 children exposed.

a. Based on last five years.

b. Calculated from urban breakdown.

c. Education categories are 0–2 years, 3–5 years, primary complete, and secondary or higher.

d. Secondary only.

Source: Rutstein 1991.

micronutrient deficiency (Leslie 1991). The enormity of this problem has recently been shown by Coale (1991), who analyzed the estimated deficits in the female population of several Asian countries; the deficits were derived from a comparison of the actual ratio of males to females with the expected ratio if there were no excess female mortality. For China and India, from 5.3 to 5.6 percent of females were “missing,” indicative of a deficit of 52 million in these countries.

Although noncommunicable diseases and injury will become more prominent with the epidemiologic transition, the infectious diseases, malnutrition, and excess (unwanted) fertility cannot be ignored. These will, however, become even more concentrated among the poor, leading to the phenomenon of epidemiologic polarization. Tuberculosis is illustrative of a leading disease that remains on the unfinished agenda of developing country health problems. In most developing countries, the annual risk of infection ranges now from 0.5 to

2.5 percent, a level 50 to 200 times greater than in the industrial countries. The estimates of Murray, Styblo, and Rouillon (chapter 11) indicate that this will result in approximately 7.3 million new cases and 2.7 million deaths in 1990. More than two-thirds of these deaths will be among productive adults (ages fifteen through fifty-nine), primarily the poor. Significantly, this disease alone accounts for about 26 percent of an estimated 7 million *avoidable* adult deaths in the developing world. Assuming no change in the present trends of decline and no improvement in case detection and treatments, Murray, Styblo, and Rouillon project as many as 2.9 million tuberculosis deaths still occurring by 2015. Because of the contribution of the HIV epidemic to tuberculosis, coupled with the rate of population growth in Sub-Saharan Africa, the number of deaths projected could increase by more than 100 percent in that region during the next twenty-five years.

Consequences for the Health System

A central consequence of the health transition for health policy is that in most developing countries, pre- and post-epidemiologic transition problems will coexist. Omran (1971) predicted evolution toward this state of epidemiologic diversity in his original essay on the epidemiologic transition; Evans, Hall, and Warford (1981) and Hiroshi Nakajima (World Health Organization, 1988) further described the trend; and the authors of several World Bank country-specific analyses (Jamison and others 1984; World Bank 1989 and 1990a) have attempted to draw appropriate implications for policy. In table 29-7 we attempt to summarize, for each of the age categories we are using, which health problems on the current agenda need continued attention and which neglected or emerging problems are likely to require substantial increases in effort. The latter are considered in the light of the indicated change in the age distribution of mortality. As Foege and Henderson (1986, p. 321) have observed, these countries "will not have the luxury of dealing with two kinds of problems sequentially. For the remainder of this century they will be dealing with both simultaneously." Health systems of developing countries will, then, be facing unprecedented increases in the volume and diversity of problems they must address; the challenge is to respond with maximal effectiveness, given the sharp constraints on their resources. Assessing intervention

cost-effectiveness is an essential first step to meeting that challenge.

The composite effect of the demographic transition and the socioeconomic changes on the health system that are foreseeable for the next thirty-five years—mainly urbanization and higher levels of education—will be formidable. Four main effects are highlighted as they apply to most of the developing countries.⁴

First, the total burden of disease, measured by the number of days that people suffer from acute episodes of disease, chronic disabilities, and days lost as a result of premature death, will increase. This is not only because the population will continue to grow but also because the prevalence of disease will increase as more chronic diseases predominate in the health profile. The adult population suffers more diseases simultaneously and these tend to last longer, as compared with child morbidity. In addition the emergence of new health risks as described in the previous section will lead to higher rates of incidence of some conditions, particularly lung and breast cancer, some accidents and violence, and AIDS.

Second, the demand for health services will be greater. Demand is a direct function of three factors that tend to move in the same direction: (a) health needs that were described before; (b) the threshold for converting need into demand, which will decrease as a result of the higher levels of income and education of populations and the accessibility to informa-

Table 29-7. Health Problems Affecting Various Age Groups in Developing Countries

Age group	Population (millions)		Deaths (millions)		Important health problems	
	1985	2015	1985	2015	Unfinished agenda	Emerging problems
Young children (0–4 years)	490	626	14.6	7.5	Acute respiratory infection Diarrheal disease Learning disability Malaria Measles, tetanus, polio Micronutrient deficiencies Protein-energy malnutrition	Injury Learning disability
School-age children (5–14 years)	885	1,196	1.6	1.3	Geohelminth infection Micronutrient deficiencies Schistosomiasis	Learning disability
Young adults (15–44 years)	1,667	2,918	5.0	6.0	Excess fertility Malaria Maternal mortality Tuberculosis	AIDS Injury Mental illness Sexually transmitted diseases
Middle-aged (45–64 years)	474	1,131	5.9	10.4	None	Cancers Cardiovascular disease Chronic obstructive pulmonary disease Diabetes
Elderly (65+ years)	153	358	11.0	22.5	None	Cataracts Depression Disability
Total	3,669	6,229	37.9	47.7		

Note: Many conditions for older age groups manifest themselves clinically long after the processes leading to the clinical condition have been initiated; preventive intervention will, therefore, need to be directed to younger populations.

Source: Figures for population and deaths calculated from Bulatao and Stephens 1990.

tion acquired in urban areas through radio and other mass media; (c) finally, the supply of services, particularly those provided by hospitals, that is, the increased proportion of populations living in urban areas will improve the physical access to health facilities and therefore will boost the demand for services.

Third, the emergence of noncommunicable diseases and disabilities due to injury will increase considerably the complexity of the health care services required. In general, health personnel will require higher qualifications and probably some level of specialization. The technology for diagnosis, treatment, and rehabilitation will be more sophisticated, and the organizational arrangements to ensure minimum standards of care will also increase in complexity.

Fourth, all the previously described effects will increase expenditure for health care. The one that has the greatest relevance is probably the higher cost of medical care that will result from the greater complexity of services, particularly the introduction of new health technologies. The greatest effect of the health transition is likely to be seen in hospitals (Barnum and Kutzin 1993). Most developing countries provide hospital services for only a fraction of the population. The demand for services is already greater than the supply. The shortage of hospital beds will, according to the effects described above, be exacerbated. Three primary causes for hospital admission are likely to grow: childbirth, noncommunicable diseases, and injuries.

Policy Implications for National Governments

Chapter 1 assembled the cost-effectiveness findings from each of the disease-oriented chapters. These findings were grouped as population-based interventions and facility-based interventions as described in table 1-2. Notably, this analysis does not weigh preventive as opposed to curative strategies but, rather, considers the cost-effectiveness of the full range of interventions—primary prevention, secondary prevention, curative, rehabilitation, and palliation—on the same scale. Our purpose in this section is to explore the implications for policy. We stress here that conclusions for policy are highly dependent on the local epidemiological, administrative, and financial context; it is within such contexts (at the national or district level) that policy is shaped. All that can be done in a general overview, such as this, is to point to policies that appear approximately valid for a range of countries and that, therefore, are likely to serve as a useful starting point for country- (or district-) specific analysis of policy.

Policy Instruments of Government

When intervention is desirable, governments have available a variety of measures to promote health and prevent disease that include but extend far beyond the usual activities of ministries of health.⁵ Governmental interventions may be usefully grouped into five broad categories, the first three of which are

associated with modifying the incentives and knowledge of patients and providers. These are listed as the instruments of policy in table 1-2; these instruments are further discussed below.

- *Providing Information.* Fundamental to any improvements in health behavior among the population are information, knowledge, and skills, ideally reinforced with social support. In recent years, governments have begun to use the media and modern communication technologies to reach the public with information to promote good health behaviors through programs of “information, education and communication.” Often this is done effectively in partnership with the private sector. Perhaps the most notable examples of this in a number of developing countries are mass mobilization efforts in support of immunization campaigns, as well as communication programs to improve maternal weaning practices and promote the practice of family planning. In the United States, recent publication of selected operative mortality and success rates, by hospital, has allowed more informed consumer choice to stimulate quality assessment and control in hospitals.

- *Regulation/Legislation.* Health ministries generally have considerable regulatory powers, for example, in licensure of practitioners, and in food and drug control and sanitation, though resources for inspection and enforcement are often limited. A central regulatory power of governments lies in the determination of which health services will (can) be privately provided (through market mechanisms or through nongovernmental organizations) and which will be provided by the state. When coupled with effective public education to reach a social consensus, regulatory authority can be an effective tool for health promotion, as evidenced by the ability of some governments to limit pollution levels and to restrict the advertising of cigarettes or the promotion of infant formula and baby bottles.

- *Taxes, Subsidies.* Taxes or price subsidies can be an important tool available to governments to promote or discourage various practices related to health. The judicious application of high taxes can discourage consumption of cigarettes and excess consumption of alcohol, whereas subsidized prices—for example, for contraceptives—can be a tool to promote desirable behaviors. Fuel taxes can reduce motor vehicle use, thereby decreasing pollution and vehicle accidents, to take another example. Similarly, reduction of subsidies of some very high-fat food products can discourage consumption of fat.

- *Direct Investments.* In many circumstances the only (or best) recourse for the government may be direct investments perhaps with policies of partial cost recovery.⁶ Immunization programs and vector control are two examples on the prevention side. The complexity and relative infrequency of many case management procedures, combined with the absence of informed consumers, suggest that a prominent role for government in the financing of a basic level of hospital services may be desirable.

- *Research.* Even if research results are protected by patent, it can be difficult for the private sector to recoup the cost of research investment, and, when it is recovered, it is at the expense of fully appropriate use of the research product. (Comanor [1986] reviews an extensive literature on these issues in the context of the pharmaceutical industry.) The economic case is typically strong, then, for heavy contribution by government to finance research. The purpose, of course, is to lengthen the menu for intervention choice.

An Integrated Approach to Policies and Strategies

In this collection we look at diseases or related conditions (for example, cancers, helminthic infections) one at a time. Although this disease-by-disease approach facilitates the technical analyses of costs and effectiveness of specific interventions, in reality, policymakers and health planners must use a more integrated strategy and consider packages of interventions. In this situation, issues of feasibility and sustainability arise (Vilnius and Dandoy 1990).

Feasibility encompasses political, administrative, and logistical considerations. Some policies, such as raising the age of marriage, may not yet be politically acceptable; others, such as establishing environmental monitoring, may not be administratively feasible because of lack of legal authority or trained personnel. Lack of a well-functioning health infrastructure or an efficient distribution system may be a logistical barrier reducing the cost-effectiveness of some strategies in the short run.

Sustainability is a particularly serious concern, since before this decade, few developing countries had seriously attempted to implement a health care program with their own resources, where total population coverage was the objective. Consequently, the international community and national governments are learning that even highly cost-effective interventions like immunization programs may exceed the available resources of some developing countries in the current economic climate. An advantage of the analytical approach taken in this collection is that it identifies a range of health policies and strategies, some of which may require only minimal government resources (for example, regulations) and some that can even generate revenue (for example, taxation on tobacco). This approach does, however, require health ministries to transcend their traditional bounds and look at the entire national development strategy with regard to its consequences for health.

In chapter 1, health interventions are classified as *population-based* or *clinical* (tables 1-5 and 1-8). The population-based interventions encompass five strategies: (a) change of personal behavior; (b) control of environmental hazards; (c) immunization; (d) mass chemoprophylaxis; and (e) screening and referral. Clinical interventions are assumed to occur, for simplicity, at three levels: (a) the clinic; (b) the district hospital; and (c) the referral hospital. The discussion below follows this same framework, elaborating on issues that must

be addressed by policymakers in designing cost-effective intervention programs.

BEHAVIORAL CHANGE. Behavioral change includes personal behaviors related to diet, hygiene and sanitation, personal health habits, reproduction, and self-care or self-referral for illnesses. Worldwide experiences with agriculture, nutrition, family planning, and child survival programs have made it clear that effective population-based health care requires active and informed participation by families and communities (Hornik 1988). Programs to prevent deaths from diarrhea and respiratory infections in infants and children require that mothers be motivated and trained to become informed diagnosticians and managers of home therapy (Berman, Kendall, and Bhattacharyya 1989; Mosley 1989). Correspondingly, family and community involvement is essential for appropriate antenatal and childbirth care (Walsh and others, chapter 17), for effective nutrition intervention programs (Pinstrup-Andersen and others, chapter 18), for early diagnosis (Stansfield and Shepard, chapter 4), and for compliance with treatments for chronic conditions such as tuberculosis or hypertension among adults.

Each of the first four of the policy instruments of government noted above may need to be invoked to promote desired behavioral changes. The most direct approach is through mass media. Most governments are using radio and television broadcasts and print mass media to reach the general population with health information and promotional messages. In recent years there have been important developments in mass communication strategies that are greatly enhancing their effectiveness in creating public awareness of health problems and supporting appropriate behavioral changes (Church and Geller 1990; Gilluly and Moore 1986). Key elements of effective communication programs include identifying the target audiences and conducting preliminary research to tailor the message to their specific needs. Also, the media chosen must be able to reach the target group. Most important, implementation of a communication program must be a learning process—all materials must be pretested and modified, and the effect of the program must be carefully monitored and evaluated.

Entertainment for social change is a new concept in health communications that is rapidly gaining worldwide prominence (Coleman 1988; Coleman and Meyer 1990). This method uses the universal appeal of entertainment by bringing together popular entertainers, skilled producers, and health professionals to show people how they can live safer and healthier lives. To date, this strategy has been used most successfully in the field of family planning, with productions ranging from music videos in Latin America and the Philippines to television dramas and soap operas in Nigeria, Egypt, India, and Mexico. Often these productions are of such high quality that they gain top ratings on popularity charts. An advantage of this is that they are often broadcast on commercial channels at no charge, therefore providing a major subsidy to the health education program.

Although the mass media are useful in introducing new ideas and providing information in support of health programs, the production of sustained behavioral changes in the population generally requires a more comprehensive strategy, incorporating the more persuasive instruments of government to consolidate behavioral change. Perhaps the most neglected tool here is taxation: estimated price elasticities of demand for alcohol and tobacco products are substantial.⁷ Such integrated strategies are discussed in detail in the chapters on injury (Stansfield, Smith, and McGreevey, chapter 25), protein-energy malnutrition (Pinstrup-Andersen and others, chapter 18), and cancers (Barnum and Greenberg, chapter 21).

ENVIRONMENTAL HAZARDS CONTROL. Environmental health and safety is largely a matter of engineering and regulation to reduce health risks from known environmental hazards, even when occurrences of the hazard may be increasing. For transport-related injuries, although the number of motor vehicles and the distance driven are increasing, it has been shown that the combined effect of seat belts, speed limits, safer roads, better vehicles, drunk driving prevention, and so forth, has been to reduce the health risk (Kjellstrom and Rosenstock 1990). This pattern has been observed in industrial countries and in a few developing countries in which safety programs have been implemented and data are available.

As with motor vehicles, one can project a rapid increase in modern environmental health hazards associated with industrialization and urbanization in developing countries. The problems of environmental control will be compounded in many countries, however, because the low incomes and standards of living mean that the traditional hazards associated with poor sanitation will remain.

The underpinnings of environmental hazards control are: epidemiologic surveillance to detect illnesses or injuries related to environmental risks swiftly; regular monitoring of potentially hazardous environmental conditions; and regulatory or taxation authority to ensure that appropriate risk reduction actions are taken. Traditionally, environmental control programs in ministries of health have been limited to water, food, and sanitation inspection to reduce infectious diseases. Government capabilities and authority in this area must be greatly expanded to monitor and control a much broader range of environmental risks, including air pollution, toxic wastes, traffic hazards, occupational safety, unsafe manufactured goods, and other health risks. Some of the professional and technical capacities required to monitor and regulate environmental hazards may exist in different ministries in government; however, their functions are often limited by insufficient technically trained personnel, limited resources, and, particularly, lack of statutory authority.

Significant government initiatives in environmental hazards control must begin with broad and detailed statutory regulations empowering one or more agencies to take effective actions. Given the scope and magnitude of the tasks to be carried out—which will encompass areas as diverse as law, engineering, medicine, economics, physics, and chemistry—

environmental protection agencies may be set up independently of ministries of health. However the administrative structure is organized, because of the nature of environmental hazards control, the activities must be administered in a way that facilitates maximum coordination and collaboration among diverse government agencies whose operations will directly, or indirectly, impinge on environmental health. Table 29-8 indicates the range of government agencies and programs outside the health sector that may need to be involved in implementing environmental health activities.

Resources are limited in developing countries, but the multi-sectoral character of environmental control programs means that their cost may be spread across government agencies and, by regulation and taxation, through the private sector. Thus, environmental improvements, although still constrained by overall national resources, are not dependent upon the budget of a single ministry such as the ministry of health. A broad discussion of approaches to environmental improvement is available in the World Bank's *World Development Report* for 1992.

Consider motor vehicle injuries as an example. The health ministry may take the leading role in surveillance and identifying the growing problem. But a policy recommendation limited to establishing emergency care units without involving

Table 29-8. Agencies Responsible for Health-Related Environmental Improvements

<i>Environmental concern</i>	<i>Relevant agencies</i>
Water availability	Public works
Water quality/fluoridation	Industry
Waste disposal	Agriculture
	Forestry
	Urban development
	Rural development
Food safety	Agriculture
Food fortification	Industry
	Trade
Vector control	Agriculture
	Urban development
Motor vehicle/road safety	Roads and highways
	Import control
	Alcohol control
	Transportation
Occupational safety	Labor
	Industry
	Agriculture
	Alcohol control
	Transportation
Air quality	Motor vehicle control
	Industry
	Power development
Housing quality	Urban development
	Rural development
	Housing
	Public works

Source: Authors.

other relevant sectors in activities such as initiating measures to upgrade roads, highways, and intersections; improve motor vehicle safety; and reduce drunk driving and pedestrian hazards would rapidly produce diminishing returns. An intersectoral effort toward the prevention of motor vehicle injuries can be expected to have a synergistic effect, thus making the overall strategy more cost-effective. This example can be multiplied with many environmental approaches to health interventions, as table 29-8 indicates. It reinforces the rationale for an environmental protection agency with broad authority to monitor hazards and take legal action.

IMMUNIZATION, MASS CHEMOPROPHYLAXIS, AND SCREENING. The population-based interventions included under the headings immunization, mass chemoprophylaxis, and screening all share certain characteristics: (a) they involve the direct administration of a specific technical intervention to individuals on a one-by-one basis; (b) they are directed to certain target populations; and (c) coverage of the target population is important to producing the desired effect. Technically, each of these intervention strategies is highly effective when correctly applied to a compliant subject, but their actual effectiveness in developing countries is strongly conditioned by the local administrative, managerial, and logistical capabilities, by traditional cultural constraints, and by epidemiologic factors.

It is particularly with the interventions in this category that the decision criteria noted in the section "An Integrated Approach to Policies and Strategies," above, need to be carefully applied by policymakers, because the one-on-one character of these interventions means that they are intrinsically demanding of resources in terms of personnel and logistics. Even if the criteria are satisfied at the planning stage, these interventions require careful monitoring and evaluation for their effect during implementation; any breakdown in the technical requirements of the intervention, any failure to reach the target population, or inadequate compliance with required procedures by the recipients can greatly reduce their cost-effectiveness.

Traditionally child survival interventions which are targeted to the same group (such as immunizations, micronutrient supplementation [particularly vitamin A] and growth monitoring) are combined into an intervention package to make more efficient use of limited resources. This strategy can be very cost-effective if each of the specific interventions is carefully monitored and regularly evaluated to see that it meets the standards required for an effective program and that it produces the desired effect on health in the population. If, however, an activity is simply added to an operating program and no procedures have been properly established to ensure a health effect, efficiency will decline. This has frequently been the case when growth monitoring (a screening tool) has been introduced into child survival programs without any provision to attend to children with faltering growth (Gopalan, cited by Pinstrip-Andersen and others, chapter 18). Conversely, when growth monitoring is used as a tool to manage a population-based nutritional supplementation program, as has been done

in Tamil Nadu State in India, substantial program efficiencies can be achieved (World Bank 1990).

Cost savings to government for these mass interventions may be achieved through the use of mass mobilization campaigns, in which a substantial contribution in kind may be provided by the private sector. This has been the case with polio immunization mass campaigns conducted at intervals of six months in some Latin American countries. Program efficiencies can also be achieved by focusing efforts in places where the target population will be concentrated. Warren and others (chapter 7) propose school-based delivery of "targeted mass chemotherapy" for intermittent (six-month or annual) mass treatment for helminth infections with the objective of reducing worm burdens, and hence morbidity, without necessarily eliminating infections. The rationale is that in heavily infected populations it is not the acute effects of infection that are the major public health concern but the chronic insidious effects of continuous moderate to heavy infection throughout childhood, which reduces the growth and intellectual development of children. Immunizations are among the most cost-effective of interventions discussed in this collection, and school-based anthelmintic chemotherapy also appears highly attractive.

Where provision for treatment and follow-up is available, screening selected populations for infectious diseases is also cost-effective, for example, miners for tuberculosis and commercial sex workers for STDs. The latter strategy has recently gained in significance as an important public health intervention for two reasons. First, there is evidence that some STDs play a role in the transmission of AIDS. Second, theoretical work suggests that reducing the risk of HIV transmission by a small core group of infected carriers with multiple sex partners is a much more effective means of limiting the epidemic than treating a much larger group of people with few sex partners (Over and Piot, chapter 20). Other diseases for which screening and referral are at least moderately cost-effective are breast and cervical cancer (Barnum and Greenberg, chapter 21). Murray, Styblo, and Rouillon, however, the authors of the chapter on tuberculosis (chapter 11), do not recommend active case finding.

CLINICAL INTERVENTIONS. Chapter 1 summarizes the range of health interventions that require medical facilities, the level of facility required, and the estimates of cost-effectiveness. As with population-based interventions, national policymakers should have an informed epidemiologic analysis in the local context, along the lines of the framework given here, to guide the allocation of resources across clinical facilities of varying complexity and cost (Barnum and Kutzin 1993). Operationally, the choices for clinical interventions should actually be for packages of activities, because once certain institutional resources are established (for example, a surgical suite with blood bank), many procedures can be performed at marginal cost. As emphasized in the discussion in chapter 1, however, the factor to consider is not just the marginal cost of the procedure but its cost-effectiveness with regard to disability-

adjusted life-years gained. Institutional capacities will be limited, and the time and resources spent on relatively ineffective procedures, such as surgery for lung cancer, will be taken away from resources that could be spent on highly cost-effective interventions, such as cesarean section for obstructed labor. From the perspective of developing public policy, the extent to which economies of scale will (or will not) result from a packaging of services or from delivering required volumes of procedures determines the extent to which competitively provided services can be efficient in any given demand environment. There is much anecdotal evidence to suggest that actual economies of scale sharply limit the scope for competition to be efficient, suggesting the importance of government in financing a basic level of care or regulating hospital services.

Barnum and Kutzin (1993) provide a comprehensive analysis of the economic and financial issues surrounding resource allocation to hospitals in the public sector. They note that hospital operating expenses, which commonly absorb from 40 to 80 percent of public sector health resources, are at the core of the gap between required and available health resources in many countries. In addressing this issue, they make several observations that are relevant to this collection. First, they confirm that in low-income economies nonhospital interventions are more efficient in dealing with prevalent health conditions. They point out, however, that in countries with highly successful primary health care programs (China and Sri Lanka) a substantial proportion of health resources (above 60 percent) is spent on hospitals. Still, these are not large, tertiary facilities with sophisticated high-technology equipment, but district-level hospitals.

This leads to Barnum and Kutzin's second point relating to efficiencies within the hospitals. In many low-income countries, a high proportion of hospital expenditure is for personnel. With fiscal constraints, hospitals, particularly lower-level facilities, may be inadequately provided with drugs and other essential supplies, resulting in low admission and turnover rates. This can lead to misuse of tertiary facilities for minor illnesses and can contribute to the inappropriate provision by all hospitals of extended care or convalescence in order to maintain bed occupancy levels. The implication of Barnum and Kutzin's analysis is that hospital efficiency can be improved by more effective allocation of resources to increase the quality of care. This means strengthening both technical and managerial skills, as well as providing for sufficient drugs and supplies to care effectively for a selected group of conditions for which interventions can be cost-effective.

In considering specific activities that may be carried out in different levels of facilities, we briefly discuss certain generic issues related to continuing education for health providers and the assessment, development, and control of technology. We deal with these issues here because they are essential ingredients in the process of selecting and implementing cost-effective interventions in hospitals and other facilities.

CONTINUING EDUCATION FOR HEALTH CARE PROVIDERS. A critical element in developing cost-effective health care systems

is the reorienting and retraining of health care providers. The worldwide experience in initiating national programs to provide family planning services and child survival technologies has revealed that the vast majority of doctors, nurses, and other health care providers do not have the necessary training and technical skills to provide even basic contraceptive technologies. Before the introduction of oral rehydration therapy, which rationalized diarrhea management, hospitals in many developing countries were experiencing acute diarrhea case-fatality rates as high as 10 to 30 percent; 99 percent of these ought not to have occurred, given the availability of intravenous fluids. Even now, in countries in which oral rehydration therapy has been introduced and available for five to ten years, many physicians typically administer unnecessary and, at times, dangerous drugs to patients with diarrhea (Mamdani and Walker 1986; Martines, Phillips, and Feachem, chapter 5). Similarly, in cases of acute respiratory illnesses medical practitioners may prescribe as many as three to six drugs, including more than one antibiotic, often in ineffective doses (Quick and others 1988). Furthermore, systematic patient follow-up is rarely carried out in primary health care facilities to see if the treatment has been effective.

Many of the limitations described above are the result of resource constraints; however, it should be apparent that there will be no cost-saving by poorly trained personnel dispensing ineffective treatments (Stansfield 1990). Rather, for health care to be cost-effective, health professionals and their support staff must be trained and motivated to diagnose and treat properly the diseases they see. Much more use of practical diagnostic algorithms, continuing education programs, and careful supervision are essential to achieve this goal. Good records and case follow-up must become an integral part of treatment programs, since most of the benefits of therapeutic regimens are lost without proper patient compliance. With limited resources, gains in cost-effectiveness can be achieved only by limiting the range of conditions to be cared for, and by doing the job well. Although the selective disease-specific strategy of vertical programs is commonly criticized because of the presumed lack of efficiency in the use of medical manpower, it has had the advantage of focusing attention on each critical step necessary to make an intervention effective (Taylor and Jolly 1988; Mosley 1988). At the same time it builds a base of practitioner competence that can later be extended to providing a broader range of services.

An important step in the process of improving the qualifications of health providers is strengthening professional associations. Presently, professional associations in many developing countries are heavily dependent on commercial enterprises (primarily the pharmaceutical industry) for national meetings, publications, and continuing education. With this limited exposure to technical developments, health providers are in no position to judge the merits (much less the cost-effectiveness) of new products for patient care. Continuing education with recertification of competence, which is a requirement in highly developed countries like the United States, where physicians have virtually unlimited access to the

medical literature, is essential in developing countries, where resources are severely constrained. National professional associations could play a vitally important role in this area, but government financial support is likely to be required to facilitate provision of unbiased information.

TECHNOLOGY ASSESSMENT, DEVELOPMENT, AND CONTROL. Even in a wealthy nation like the United States, private hospitals are not permitted to introduce expensive high-technology procedures (for example, open-heart surgery) without permission of a government-mandated review board, which assesses the demand for heart surgery and the availability of the procedure in other hospitals in the area. The hospitals themselves are also shortening the duration of inpatient stay and moving many procedures to the outpatient facilities to cut costs. And consumer groups are demanding cost-saving innovations like the availability of less expensive generic drugs instead of the costly proprietary products.

In the financially constrained environment of developing countries, cost containment is even more essential. To move in this direction requires institutional capabilities as described in the section "Policy Implementation and Health System Responses," below. But beyond a control function is the critical need for research to adapt highly effective technologies to developing countries. This was done with oral rehydration therapy for diarrheal diseases, and steps are being taken to simplify the diagnostic requirements for effective treatment of acute respiratory infections (Martines, Phillips, and Feachem, chapter 5; Stansfield and Shepard, chapter 4).

Adaptations of medical technology to developing country settings have not only involved prevention and medical treatments but surgery as well. Female surgical sterilization traditionally had been an inpatient procedure done under general anesthesia. Experience has accumulated over the past twenty years with performance of a mini-laparotomy that can be done under local anesthesia on an outpatient basis (Liskin and Rinehart 1985). Cataract extraction is another procedure adapted to conditions in developing countries. High-volume surgical facilities have been in place in India and Pakistan for the past twenty years. In these settings, cataract surgery can be performed inexpensively and safely on an assembly-line basis. More recently, a pilot program in Kenya has demonstrated that nonphysician ophthalmic clinical officers can be trained to perform cataract surgery with acceptable results (Javitt, chapter 26).

An important case study of the adaptation of technology on a national scale is the "simplified surgery system" developed in Colombia (Velez Gil and others 1983; Yankauer 1983). Controlled trials of selected surgical procedures were conducted, comparing their safety and effectiveness when performed as ambulatory procedures with that when performed as inpatient procedures. The results indicated that 75 percent of surgical interventions did not require hospitalization. The government has now instituted a nationwide program of ambulatory surgery.

Analytic Capacity Building

The fundamental underpinning of any health intervention program is measurement and evaluation. Without measurement of the nature and magnitude of the health problem in a population and its trends and determinants, it is impossible to design intervention strategies that maximize the effectiveness of the health technologies. Correspondingly, in the absence of quantitative indicators of program performance, it is impossible to assess the efficiency of an intervention strategy, much less undertake analyses of the cost-effectiveness ratios of alternative policy options. Managers of the smallpox eradication program stress the central role that outcome measurements played in the success of that program (Fenner and others 1988).

In health intervention programs, measurement problems are complex, but work has begun in developing the survey tools and analytical methods (White 1985; Gray 1987). Feachem, Jamison, and Bos (1991, p. 45) have reviewed experience with (and findings from) a range of analytical advances as applied in Africa and conclude that "several new and powerful approaches—use of indirect demographic methods, case-control epidemiologic techniques, and particularly, expanded use of sentinel districts and facilities—offer highly cost-effective ways for health ministries to meet an important part of their information needs."

The microcomputer is the most important technical advance supporting the development of strengthened information systems (Berge, Ingle, and Hamilton 1986). Microcomputers have now been adapted for a wide range of health care applications in developing countries by the World Health Organization and the U.S. Centers for Disease Control, including managing primary health care programs and drug supply systems, monitoring immunization coverage, and standardizing nutrition surveys (Victoria 1986; Wilson and others 1988; Hogerzeil and Manell 1989; Babikir, Dodge, and Pett 1989). Specialized software packages are also available for demographic data analyses, field survey research applications, health and population program planning, and so forth. Wide applicability of epidemiologic and economic analyses will require much more trained manpower in developing countries.

Many governments will need to encourage the creation of new institutions or reconfigure old ones in order to address the issues identified here. Critically needed capacities include:

- *Demographic Analysis.* These capabilities provide the fundamental underpinnings of a population-based health system. There must be accurate measures of the numbers and distribution of the population, its social and economic characteristics, and the trends and determinants of population change. These data will provide the basis for designing intervention strategies as well as for assessing the effect of the disease burden on the population.
- *Epidemiologic Surveillance.* This capacity is essential to assess the magnitude of health problems, define their determinants, and monitor the effect of health program interven-

tions. At the present time in most developing countries, surveillance is limited to measuring the performance of a few infectious disease control programs. Epidemiologic capacities will need to be greatly strengthened as health program strategies move more toward regulation, taxation, subsidies, and information programs in order to reduce acute and chronic disease risks by changing behaviors and improving environmental safety.

- *Economic Analysis.* The demographic and epidemiologic capacities will only measure the burden of disease, its trends, determinants, and the effect of interventions. Economic analysis will be essential to measure the cost-effectiveness of alternative intervention strategies as well as to assess the overall claim of the health sector on scarce development resources (Barnum and Kutzin 1993). Building capacities in this area involve strengthening health service information systems to measure more effectively the resource inputs, the operations of the service delivery system, and its program outputs. Continuing comprehensive analyses of these data will be required to determine the cost-effectiveness of various operational programs. This activity must encompass the private as well as the public health care sector.

- *Health Technology Assessment.* One aspect of cost-effectiveness analysis has become known as health technology assessment; institutional capabilities in this area must include not only the assessment of the effectiveness of new drugs, vaccines, or equipment but also their costs and benefits when introduced into the health system. For example, there may need to be some control of the introduction of expensive high-technology health care interventions such as computerized axial tomography, or CAT, scanners or open-heart surgery in order to control health service delivery costs. More important, because drugs account for 40 to 60 percent of the health budget in many developing countries (not including private expenditure), there is an urgent need to build up the institutional resources to assess these products, not only with regard to safety and effectiveness, but with regard to use and cost (Mamdani and Walker 1986).

Policy Implementation and Health System Responses

The discussion above leads to five central conclusions for policy:

- A comprehensive health policy should move on multiple fronts simultaneously, considering the full range of facility-based and population-based options for any problem being addressed.
- Health strategies should be goal oriented, with specific quantitative intermediate objectives against which program achievements can be measured.
- Planning the appropriate intervention mix should specify as far as possible the quantitative relationships between

program inputs (and their costs), outputs, and expected outcomes.

- Information systems must be established that provide timely data on health outcomes, intermediate objectives, and program inputs and costs.
- Regular analyses of input-output-outcome relationships with respect to the instruments of government policy must be carried out to ensure that the instrument mix is, in fact, inducing the desired level of operation of the range of interventions.

Selecting health care priorities in a given setting is only the first step toward improving the allocation of resources in the health sector (Murray 1990). The analysis of the burden of disease would ideally lead to a list of health problems ranked by order of importance. But clearly, the fact that a health problem is high priority does not lead automatically to the decision that the government should invest in prevention or case management. As has been shown in this collection, the role of cost-effectiveness analysis is to inform decisionmakers what interventions are likely to yield more years of healthy life and therefore are preferable. The results from the cost-effectiveness analysis can be used to make decisions at two different levels: first, to set priorities among the alternative interventions available to control a specific disease (for example, measles) or to reduce the exposure of the population to a specific risk factor (for example, tobacco); second, to set priorities within the health sector, selecting the most cost-effective interventions for those health problems that produce the greatest burden of disease.

The identification of these high-priority interventions still is insufficient to justify public investment. For example, it is clear that in many countries, some of the cost-effective interventions are already being delivered by the private sector (including traditional practitioners) or by voluntary organizations and, therefore, intervention by the government is not justified. In family planning, for example, there is strong involvement of the private sector in many countries (Lande and Geller 1991).

High-priority interventions, for which government involvement is justified, deserve a level of investment to achieve the greatest possible coverage and the highest quality standards. But to achieve these goals and the ultimate outcome on health status, the health system needs to have the infrastructure and organization to deliver the services. Table 29-9 shows a framework that integrates three criteria—burden of disease, cost-effectiveness, and health system strength—to set priorities and define more specifically the response from the health system. Strategies are suggested to strengthen the health system, if the system is weak, including development of trained staff and necessary infrastructure. Other possible combinations of these three criteria are also shown, and possible responses from the health system are suggested. Importantly, this framework indicates that an intervention with a very unfavorable

Table 29-9. Responses of Strong and Weak Health Care Systems to Burden of Disease

Burden of disease	Intervention cost-effectiveness	Strong health systems	Weak health systems
High	High	Aim for full population coverage Improve quality of services provided	Reorient/train existing staff Develop technical/ management systems Establish infrastructure
	Low	Research to improve interventions Do not expand services Institute cost recovery	Research to improve interventions Restrict or eliminate services
Low	High	Target high-risk groups	Provide services on demand
	Low	Restrict services or provide cost recovery	Eliminate services

Source: Authors' design.

cost-effectiveness ratio that is aimed at controlling a disease with low prevalence and low lethality clearly is a good candidate for rationing or elimination.

Another combination of criteria of interest to developing countries passing through the later phases of the epidemiologic transition is that of available interventions for high-priority diseases that have unfavorable cost-effectiveness ratios. The most obvious example of this situation at present relates to AIDS, where control of transmission in the core population offers the potential for being cost-effective (Over and Piot, chapter 20) but actual application of the interventions is difficult. The proposed response given in table 29-9 is research; operational research aimed at improving the cost-effectiveness of current approaches to patient care and to promoting and supporting behavioral change, and basic research directed to developing new interventions, that is, vaccines or better drugs which will cost less and become more effective. As noted earlier in the discussion of clinical interventions, the control of the emerging noncommunicable diseases, where tertiary hospital care is not now cost-effective, will probably depend on the development of lower-cost interventions that can be provided in district hospitals and health centers or through population-based programs.

Probably one of the earliest attempts to incorporate the analysis of the burden of disease and the cost-effectiveness of interventions into the process of health planning was developed by the Pan-American Health Organization, in collaboration with the Center for Development Studies at Caracas, Venezuela, in 1965. This is, by and large, the most comprehensive planning methodology proposed for developing countries. It provides details of the planning process and the requirements of information. Although the principles proposed were accepted, decisionmakers found them difficult to apply, mainly because the information available was inadequate and the complexity of the estimates demanded expertise not always available. Fortunately, in recent years important developments in informatics, epidemiology, and economic evaluation of health services are making more accessible the advanced methods proposed by the Center for Development Studies planning model (PAHO/WHO 1965).

Despite the importance of using explicit criteria to set health priorities for public investment in developing countries, there is not much experience with country-level applications. An important exercise was undertaken in the late 1970s in Ghana, however, which used the number of healthy days of life lost to assess the effect of diseases on health, and cost-effectiveness analysis to assess the appropriateness of alternative interventions (Ghana Health Assessment Project Team 1981). Five disease conditions were considered, namely, malaria, measles, childhood pneumonia, sickle-cell disease, and severe malnutrition. The results were used in the design of the Ghanaian primary health care program, and the methodology proposed has served as a yardstick for subsequent developments in the assessment of the burden of disease.

International Aid

We have shown some of the implications of selecting disease control priorities, from the perspective of national governments, for the process of designing and implementing programs. This section deals with implications for the instruments through which agencies providing development assistance in the health sector can channel their aid. We begin by categorizing these instruments and then turn to the implications of this review's finding—concerning the health transition and intervention cost-effectiveness—for future directions of assistance in the health sector.

Instruments of Aid

One reasonable categorization of aid follows from whether the objective is one of assisting in the provision of services, of helping to improve the policy environment, or of expanding the research base underlying new interventions or improved resource allocation (table 29-10). These instruments of aid relate closely to the instruments of government discussed in the previous section. (See also chapter 1.) Many of the successful experiences with aid in the health sector have had as their objective the *provision of services* where no services, or only inadequate services, were available. The smallpox eradication

Table 29-10. Instruments of Aid

Objective	Modality of assistance	
	Program implementation	Capacity strengthening
Service delivery	Support acquisition of drugs, equipment, and technical assistance for delivery of expanded program of immunization (EPI), vector control programs, hospital services	Invest in institutional development and staff training to improve efficacy of service delivery, for example, through improved logistics and supply systems
Policy improvement	Identify specific areas of policy improvement (such as ban on tobacco advertising or introduction of cost-recovery mechanisms) and include them (usually conditional) as part of an assistance package	Invest in development of policy and planning departments in ministries or universities; invest in staff training and advanced education
Undertaking research (including epidemiologic, evaluational, and economic analyses)	Conduct research or analyses (perhaps with involvement of aid agency or expatriate staff) to strengthen formulation of policy or delivery of service	Invest in national and international capacity for undertaking research relevant to epidemiologic and economic conditions of developing countries, both institutional and human resource development

Source: Authors' design.

effort had this objective, as does its successor, the Expanded Programme on Immunization. Mission hospitals, too, are oriented toward provision of service, as are many other forms of assistance.

The capacity of a country to deliver services will, it is increasingly recognized, depend a great deal on the *policy environment* in which systems for delivering services must function. The policy environment defines a range of key structural conditions: the mandated division of labor among public, private, and nonprofit nongovernmental organization sectors; cost-recovery policy (and financing policy more generally); referral policy; pharmaceutical policy; policy toward prevention; policy toward taxation or subsidization of health-influencing processes or commodities; and policy toward distribution of access to services. Obviously some policy environments will be conducive to inefficiency or inequity; others less so.

The potential importance of aid in assisting with improving policy has been the subject of much attention and debate in the past five to ten years. Policy-oriented aid inevitably has the flavor of exchange of policy reform for financial assistance. The extent to which such exchange is productive depends greatly on the strength of those factions in the country who are intellectually (or otherwise) committed to reform, on the substance and style of the discussions leading to agreement, and on the inherent viability of the measures adopted. Most policy-based aid to date has been concerned with improving macroeconomic policy; more than \$1.5 billion of World Bank (and International Development Association) lending in fiscal year 1989, for example, was for "structural adjustment loans" (or SALS) involving fast disbursing resource transfer and macroeconomic conditionality. The World Bank is now also using "sector adjustment lending" instruments; incremental, highly flexible resources are made available to a sector in tranches released on certification of specified progress in policy improvement. Efforts to help improve the policy environment through sector adjustment lending are playing an increasingly

important role in health sector operations at the World Bank, sometimes closely tied to provision of service in so-called hybrid projects.

Some aid to the health sector is channeled to *research and to development of research capacity* in recipient countries (see table 29-11). Among the programs:

- The Programme for Research and Training on Tropical Diseases supports biological and operational research on five major parasitic diseases and one bacterial disease that affect more than 600 million individuals; it is currently expending about \$40 million per year.
- The Human Reproduction Program deals with biological and social aspects of fertility and its regulation; it currently operates at a budget of about \$23 million per year.
- The International Clinical Epidemiology Program (INCLEN) and blindness-related programs on trachoma and onchocerciasis represent efforts of foundations (the Rockefeller Foundation and the Edna McConnell Clark Foundation, respectively) in two quite different domains.

Other important programs are well established—many of them, like the Programme for Research and Training on Tropical Diseases and the Human Reproduction Program, managed by the World Health Organization and funded by multiple donors. The influential Commission on Health Research for Development has been convened over the past several years and recently completed its work. The commission provided an extraordinarily thorough critical review of current efforts and capacities (Murray and others 1990) and of desirable directions for future effort (Commission on Health Research 1990). The Commission on Health Research has labeled this "essential national health research" and identified support of such research as a high priority. A follow-on secretariat to the commission has been established in Geneva to facilitate research efforts of individual countries.

Much research important for resource allocation is relatively nontransportable—local epidemiologic and operational analyses being important examples. Many research results, however, are transportable; lessons from Senegal and the Gambia about the effectiveness in the field of oral and injectable polio vaccine, for example, are probably almost as relevant in South Asia as they are in West Africa. The transportability of research does vary, of course. Little of use to Zaire in controlling AIDS is likely to emerge from study of sexual practices in San Francisco. Still, it is clear that much in the way of research output is transportable, leading (in economists' jargon) to important informational externalities. Existence of these externalities creates conditions in which any individual country is unlikely to invest fully in (nonpatentable) research because that country reaps only a fraction of a research project's benefits, yet it must pay the full cost. *The existence of these informational externalities, combined with substantial research capacity in donor countries, makes research a particularly viable domain for aid.* In addition, the requirement for a substantial critical mass of highly qualified (and, therefore, highly paid) scientists for much research points toward internationalization of the conduct of that research (as well as of its finances). This suggests the desirability of relatively few (but productive) venues with broad participation on the staff.

Two additional comments are worth making about research. First, despite the existence of programs that were described in the preceding paragraph, the current volume of resources going into research is quite limited. The Commission on Health Research (1990, p. 39) estimated, for example, that perhaps only a few pennies per death per year are going into research on such significant third-world killers as acute respiratory infections and tuberculosis; although relatively more is invested in tropical and parasitic disease research, the overall amount is quite limited. The commission estimates, overall, that only about 5 percent of the \$30 billion spent on health research in 1986 was oriented toward developing countries.

Second, vaccine development efforts have the potential both for providing cost-effective prevention for a much broader range of conditions than is now possible and for reducing the cost and logistical complexity of currently available vaccines. In relation to potential, research of this sort currently receives very limited support—although the recent move toward creation of a Children's Vaccine Initiative suggests that solutions to this problem may soon emerge.

In summary the objectives of external assistance involve improving service delivery, improving the policy environment, and supporting the generation of research findings that underpin development of new interventions or more informed choice from among existing ones. Table 29-11 synthesizes these points and divides intervention concerning each objective into two modalities: *program implementation* and *capacity strengthening*. Interventions oriented toward attainment of results in the short term (and, often, this will be important) naturally emphasize the program implementation modality. In the long term, however, strengthening capacity (usually capac-

ity at the national or subnational level) is essential, and, increasingly, assistance programs include substantial resources for capacity strengthening through institutional development. Often this involves direct assistance to an institution—for example, a ministry headquarters or a hospital—designed to improve its overall functioning. Relevant efforts may include staff training, reorganizational advice, or support for development of information systems. Often of particular importance for capacity strengthening is investment in education and training facilities for health professionals, including nursing, medical, and public health faculties. To be effective, such investment may require a long time horizon; but the payoff can be very substantial indeed. The Rockefeller Foundation's more than thirty-year involvement with the Peking Union Medical College, for example, has had an influence on health policy in China, including Taiwan, that extends from the 1920s to the present day (Bullock 1980).

Conclusions

Estimates of the levels and structure of cause of mortality reviewed in this chapter strongly suggest that, not only will the number of deaths rapidly increase in developing countries, but there will also be a substantial (although incomplete) shift in the distribution of causes to the relatively expensive noncommunicable diseases of adults and the elderly. This shift, and the epidemiologic diversity likely to result from a lingering heavy burden of communicable disease, will challenge health systems to mount a broader range of preventive interventions and to develop very low cost protocols for managing cases in increasing numbers. Several general conclusions follow:

- As the increasing burden of noncommunicable disease is initially likely to affect the relatively more affluent and politically vocal older age groups, governments will need to take great care to ensure completion of the unfinished agenda for improving the health of children and the poor in the face of resource demands placed (predominantly) by the relatively better off. Almost certainly this equity objective will be consistent with extending the investments in immunization and other interventions against infectious diseases, which the chapters here have shown to offer the greatest gains in healthy life per dollar invested.⁸ A key input to completing the unfinished agenda will be investment in research on vaccines—both to increase the range of conditions to be addressed and, more important, to simplify delivery logistics.
- Many of the risk factors for noncommunicable disease (smoking, sedentariness, increased motor vehicle use) tend, for at least a time, to become more prevalent with increasing affluence; in this they differ from risk factors for most communicable diseases (with the exception of AIDS). The disadvantage of this is obvious; the advantage is that taxation-based preventive policies can actually generate revenue for government while promoting health. More gen-

Table 29-11. Directions for International Aid

Objective	Modality of assistance	
	Program implementation	Capacity strengthening
Service delivery	Continue strong emphasis on most immunization and family planning programs	Develop drug logistic capacity to support implementation priorities
	Enhance emphasis on: <ul style="list-style-type: none"> • Measles immunization • Case management of acute respiratory infection • Control of vitamin A deficiency • Tuberculosis chemotherapy • Anthelmintic chemoprophylaxis • Control of sexually transmitted diseases • Control of cancer pain 	Offer pre- and in-service training of providers to effectively manage priority procedures
	Increase selectivity in delivery of ORT (oral rehydration therapy) and BCG (bacille Calmette-Guérin) immunization in low-risk environments	Develop capacity to deliver inexpensive rehabilitative services
	Sharply reduce support for hospital facilities	Reduce emphasis on general institutional development in favor of strengthening specific capacities
Policy improvement	Implement full range of policies to limit use of tobacco	Develop instruments for effecting sustainable increases in flow of resources to the health sector
	Implement policies to track and reduce use of procedures of low cost-effectiveness	Develop staff and institutional capacity for formulating and implementing policies involving taxation, regulation, and communication, as well as direct investment
	Implement policies, including control of alcohol use, to reduce occupational and transport injuries	
Undertaking research	Substantially increase aid resources for research	Develop national and international capacity for conduct of essential national health research
	Finance and assist in the conduct of exemplary ENHR programs	Develop and adequately finance international and national capacity for research on cardiovascular diseases in developing countries; also, perhaps, for other noncommunicable diseases and injuries
	Increase epidemiologic operational research on: <ul style="list-style-type: none"> • Cardiovascular disease • STDs (sexually transmitted diseases) • COPD (chronic obstructive pulmonary disease) • Injury • Mental disorders 	Maintain and extend capacity for monitoring epidemiologic trends and efficacy of intervention in well-documented populations (such as Matlab in Bangladesh)
	Assess intervention cost-effectiveness in different environments	

Source: Authors' design.

erally, increasing epidemiologic diversity will require a broader range of preventive measures; increasing use of the full range of government policy instruments (like taxes) can play an important role in implementing them. Of particular importance here is prompt national and international action to control tobacco use. Acquisition of tobacco addiction by today's youth generates the dynamic for lung cancer, COPD, and cardiovascular disease epidemics in fifteen to thirty years. Taxes, prohibition on promotion, and other effective interventions are available, and their prompt implementation is high priority.

- To help preserve resources for the poor and to ensure broad access to reasonable treatment, great effort will need to be devoted to implementing (or developing) low-cost ways of reaching the goals of secondary prevention, cure,

and rehabilitation—and to providing humane palliation for those whose lives could only be marginally extended (if at all) by affordable intervention. Some methods that are reasonably cost-effective have been identified, but significant efforts are required to develop and evaluate a more comprehensive range of low-cost therapeutic interventions.

- Today's allocation of research resources to the health sector in developing countries virtually ignores the problems that will dominate the policy agenda in years to come. This situation may have several roots: a sense that current research priorities should mirror operational ones; a sense that the National Institutes of Health and their sister institutions around the industrial world are doing what needs to be done about chronic disease; and, perhaps, a lack of appreciation for epidemiologic dynamics. Yet, as we have argued, case

management of chronic disease will have to proceed in environments drastically more cost-constrained than the ones for which institutions such as the National Institutes of Health are working; relevant research and development efforts must be modified and evaluated for cost-effectiveness in very different environments. Likewise, very little indeed is known, for example, of the descriptive epidemiology of cardiovascular disease in the developing world, and no available risk models are based on developing country data, which might include risk factors not observed in industrial countries. The list of examples could go on; the point is simply that the analytic effort to address the emerging health problems of developing countries in the 1990s and beyond has barely begun.

- Just as manufacturers with older equipment expect higher maintenance costs, older populations will generate, for a variety of reasons, higher health maintenance costs for their country. National economic planners should expect to see, as populations age, expenditure on health steadily rising as a percentage of the gross national product in the coming decades.

Appendix 29A: Regional Groupings of Countries and Territories

The following lists define the countries that are considered in the text.

Industrialized Market Economies

Australia	Japan
Austria	Luxembourg
Belgium	Malta
Canada	Netherlands
Channel Islands	New Zealand
Cyprus	Norway
Denmark	Portugal
Finland	Spain
France	Sweden
Germany, former	Switzerland
Federal Republic of	United Kingdom
Greece	United States of America
Iceland	Other Europe
Ireland	Other North America
Italy	

Industrialized Transition Economies

Albania	Hungary
Bulgaria	Poland
Czechoslovakia	Romania
Former German	Former U.S.S.R.
Democratic Republic	Yugoslavia

Latin America and the Caribbean

Antigua and Barbuda	Jamaica
Argentina	Martinique
Bahamas	Mexico
Barbados	Montserrat
Belize	Netherlands
Bolivia	Antilles
Brazil	Nicaragua
Chile	Panama
Colombia	Paraguay
Costa Rica	Peru
Cuba	Puerto Rico
Dominica	St. Kitts and Nevis
Dominican Republic	St. Lucia
Ecuador	St. Vincent and the
El Salvador	Grenadines
Grenada	Suriname
Guadeloupe	Trinidad and Tobago
Guatemala	Uruguay
Guyana	Venezuela
Haiti	Virgin Islands (US)
Honduras	Other Latin America

Sub-Saharan Africa

Angola	Mali
Benin	Mauritania
Botswana	Mauritius
Burkina Faso	Mozambique
Burundi	Namibia
Cameroon	Niger
Cape Verde	Nigeria
Central African Republic	Réunion
Chad	Rwanda
Comoros	São Tomé and Príncipe
Congo, People's Rep. of the	Senegal
Côte d'Ivoire	Seychelles
Djibouti	Sierra Leone
Equatorial Guinea	Somalia
Ethiopia	South Africa
Gabon	Sudan
Gambia, The	Swaziland
Ghana	Tanzania
Guinea	Togo
Guinea-Bissau	Uganda
Kenya	Zaire
Lesotho	Zambia
Liberia	Zimbabwe
Madagascar	Other West Africa
Malawi	

Middle East and North Africa

Afghanistan	Bahrain
Algeria	Egypt, Arab Republic of

Middle East and North Africa (continued)

Gaza Strip	Qatar
Iran, Islamic Republic of	Saudi Arabia
Iraq	Syrian Arab Republic
Israel	Tunisia
Jordan	Turkey
Kuwait	United Arab Emirates
Lebanon	West Bank
Libya	Former Yemen, People's
Morocco	Democratic Republic of
Oman	Former Yemen Arab Republic
Pakistan	Other North Africa

Asia and the Pacific

Bangladesh	Malaysia
Bhutan	Maldives
Brunei	Mongolia
Cambodia	Myanmar
China	Nepal
Fiji	New Caledonia
French Polynesia	Pacific Islands
Guam	Papua New Guinea
Hong Kong	Philippines
India	Singapore
Indonesia	Solomon Islands
Kiribati	Sri Lanka
Korea, Democratic	Thailand
People's Republic of	Vanuatu
Korea, Republic of	Viet Nam
Lao People's Democratic	Western Samoa
Republic	Other Micronesia
Macao	Other Polynesia

Notes

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our thinking of Richard Feachem and the effort he has led for the World Bank to review issues concerning the health of adults in the developing world. Last, we acknowledge those who provided valuable comments on portions of this chapter, which was given by Dean T. Jamison as the Heath Clark Lecture for 1989–90 at the London School of Hygiene and Tropical Medicine.

1. Here and in much of what follows we draw heavily on estimates based on World Bank projections (Bulatao and Stephens 1989), which typically use combinations of model life tables rather than empirical estimates of mortality. Although we are aware of the shortcomings of this method, it provides the only globally complete projection model that is currently available. A more epidemiologically based assessment of the distribution of death by cause in 1985, for the developing and the industrial countries, is presented in the chapter on cause of mortality (Lopez, chapter 2).

2. Uemura (1989) has calculated excess mortality ratios for different countries and age groups at different points in time, using, as a reference, the lowest age- and sex-specific mortality rates so far observed in any country. His conclusions clearly show that the greatest gains to be made in developing countries are in the younger age groups. (Greater gains are also possible, he shows, among females than among males at all ages, even though absolute age-specific mortality rates are typically lower for females.)

3. The Demographic and Health Surveys (DHS) is a nine-year project to assist government and private agencies in developing countries to conduct national sample surveys on population and health. DHS is funded by the U.S. Agency for International Development (USAID) and administered by the Institute for Resource Development. For more information about the DHS program (or copies of individual country reports) write to DHS, IRD/Macro Systems, 8850 Stanford Boulevard, Suite 4000, Columbia, Md. 21045, U.S.A.

4. Most of the implications of the health transition on the health system described here refer to the health care subsystem. The possible effects on the other sectors of the economy are more difficult to anticipate, despite their potential importance. Particularly relevant is the effect of ill-health in the production of goods and services and the policy responses to the potential loss in productivity.

5. For a valuable general discussion of the economic role of government, its limits, and its comparative advantage, see Stiglitz 1989. A somewhat more mathematical treatment of these matters, with an emphasis on project evaluation methods, may be found in Starratt 1988. Birdsall (1989) provides an extended discussion of the role of government in the health sector; she emphasizes its past successes in many developing countries but calls for a redefinition of its role to leave more responsibility in routine areas to private actors and to achieve greater financial and administrative responsiveness in its own operations. Akin, Birdsall, and deFerranti (1987) discuss the financial aspects of these matters at greater length. Behrman (1990) provides a clear overview of the central role of household decisionmaking (in many domains) as determinants of health; this provides a context for assessing the role of government.

6. We define "direct investment" broadly to include not only activities directly administered by government but, also, services contracted for by government or natural monopolies (for example, tertiary facilities) that may be partially privately owned or independently managed but whose policies are closely regulated in the public interest.

7. It is worth stressing, however, that when price elasticities of demand are low, taxation ceases to be effective for changing behavior; for example, raising taxes on salt, even substantially, could be expected to have only a minimal effect on consumption.

8. World Bank (1989) and Feachem and others (1992) have assembled evidence showing, convincingly, that the poor suffer more from chronic diseases than do their well-off counterparts. *Relatively*, though, the poor suffer much more from infectious conditions; hence the desirability, from a distributional perspective, of infectious disease control programs.

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